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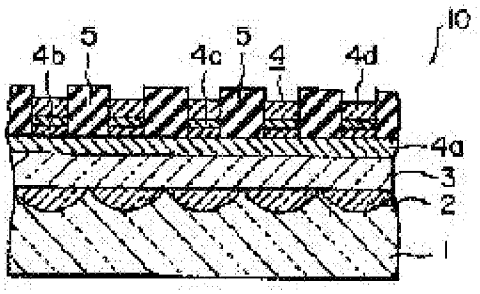
(54) ORGANIC EL LIGHT EMITTING DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an organic EL light emitting device which is high in both light taking-out efficiency and luminance when viewed from the front by arranging a condensing lens between a lower electrode to constitute an organic EL element and an outside surface of a light transmissive base board so as to correspond one to one to each other in a plan view.
SOLUTION: In a light transmissive base board 1 composed of a plate microlens, a backing layer 3 composed of thin plate glass is arranged on a surface on the side where a plane microlens (a planoconvex lens; a condensing lens) 2 is formed. An organic EL element 4 is arranged on this backing layer 3. The plane microlens 2 and the organic EL element 4 are arranged so as to correspond one to one to each other in a plan view. In this organic EL light emitting device 10, since the backing layer 3 is fixed on the light transmissive base board 1 by a transparent adhesive layer, a distance between a loer electrode 4a to constitute the organic EL element 4 and the plane microlens 2 is the same as a focal distance of the plane microlens 2. Respective organic EL elements emit the light in a green color.



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[Claim(s)]
[Claim 1]1 provided via direct or a foundation layer on one side of a light transmission nature board and this light transmission nature board, or two or more organic EL devices, And an organic electroluminescence luminescent device as it has 1 or two or more lenses for condensing which were provided between a lower electrode which constitutes this organic EL device, and an outer surface of said light transmission nature board, and said organic EL device and said lens for condensing correspond, wherein they are provided on [1 to 1] plane view.
[Claim 2]The organic electroluminescence luminescent device according to claim 1 with which a lens for condensing is formed into a light transmission nature board.
[Claim 3]The organic electroluminescence luminescent device according to claim 1 which an organic EL device is formed via a foundation layer on one side of a light transmission nature board, and is formed into a foundation layer of the above [a lens for condensing].
[Claim 4]An organic electroluminescence luminescent device given in any 1 paragraph of Claim 1 - Claim 3 whose lens for condensing is a plane micro lens of a refractive-index distribution pattern.
[Claim 5]An organic electroluminescence luminescent device given in any 1 paragraph of Claim 1 - Claim 4 by which an organic EL device is substantially formed on a flat field.

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the organic electroluminescence luminescent device which has 1 or two or more organic electroluminescence (electroluminescence) elements as a light source.

[0002]
[Description of the Prior Art]Since its visibility can be high since an organic EL device is a self-light emitting element, and impressed electromotive force can be sharply reduced compared with inorganic EL element, Development of luminescent devices (organic electroluminescence luminescent device), such as a light source, a display panel (in this case, an organic EL device is used as a pixel.), etc. using the organic EL device concerned as a light source, is furthered actively.
[0003]Generally the organic EL device which has the above-mentioned characteristic is formed on the light transmission nature board.
The light transmission nature board side concerned is made into the optical extraction side.
In the organic electroluminescence luminescent device which makes such an organic EL device a light source, the rate which can take out light (EL light from an organic EL device) from the light transmission nature board which is an optical extraction side will be about $1/(2n^2)$ (n is a refractive index of a light transmission nature board) by the total internal reflection in the aforementioned light transmission nature board. For this reason, to raise optical extraction efficiency is desired. Since EL light emitted from an organic EL device is diffusion light, its luminosity when it is conjointly regarded as the extraction efficiency of light being low as mentioned above from the front in the display panel using the organic EL device concerned as a pixel is comparatively low.
[0004]Although it is the example which raised the optical extraction efficiency of inorganic EL element, On the outer surface (the field in which inorganic EL element is formed is the surface by the side of opposite) of a light transmission nature board where inorganic EL element as a pixel is formed in JP,H4-192290,A, [or on the protection layer currently formed on the element concerned in order to protect inorganic EL element currently formed as a pixel on the light transmission nature board] The inorganic EL device which made the micro lens equivalent to a pixel (inorganic EL element) for condensing which is, carries out and has a size beyond it adjoin mutually, and provided them is indicated. [two or more] In this inorganic EL device, since the convex of each micro lens is made into the optical extraction side, it is suppressed that EL light which has penetrated the micro lens carries out total internal reflection by the interface of the micro lens concerned and air, and optical extraction efficiency improves as that result.
[0005]Although it is an example for obtaining a high definition display, using inorganic EL element as a pixel, JP,H7-37688,A has disclosed EL element which provided the cylindrical high refractive-index part prolonged in a light transmission nature board in the thickness direction of the substrate concerned, and provided the pixel which makes it correspond to this high refractive-index part, and consists of an inorganic EL element.
[0006]

[Problem to be solved by the invention]By learning from the inorganic EL device indicated to above-mentioned JP,H4-192290,A, and producing an organic electroluminescence device (organic electroluminescence luminescent device), it is possible to obtain the organic electroluminescence luminescent device whose extraction efficiency of light improved itself. However, since an organic EL device is a field light source, when the micro lens equivalent to the organic EL device concerned which is, carries out and has a size beyond it is used. EL light which enters into the micro lens concerned through **** diffused conversely without converging depending on this micro lens arises inevitably. Therefore, even if it learned from the inorganic EL device indicated in the gazette and produced the organic electroluminescence luminescent device, about luminosity when the organic electroluminescence luminescent device concerned is seen from the front, there is still room for an improvement.

[0007]Although it is possible to obtain EL element (organic electroluminescence luminescent device) which learns from EL element indicated to aforementioned JP,H7-37688,A on the other hand, and makes an organic EL device a light source itself, EL light which penetrated a high refractive-index part currently formed in a light transmission nature board which constitutes this EL element (organic electroluminescence luminescent device) is diffusion light as shown in drawing 1 of the gazette. Therefore, also in the EL element (organic electroluminescence luminescent device) concerned, there is still room for an improvement about luminosity when it sees from the front.

[0008]The purpose of this invention is to provide an organic electroluminescence luminescent device which can obtain easily what has both high luminosity when it sees from extraction efficiency and the front of light.

[0009]

[Means for solving problem][an organic electroluminescence luminescent device of this invention which attains the above-mentioned purpose] 1 provided via direct or a foundation layer on one side of a light transmission nature board and this light transmission nature board, or two or more organic EL devices, And it has 1 or two or more lenses for condensing which were provided between a lower electrode which constitutes this organic EL device, and an outer surface of said light transmission nature board, and on [1 to 1] plane view, as said organic EL device and said lens for condensing correspond, they are provided.

[0010]

[Mode for carrying out the invention]Hereafter, an embodiment of the invention is described in detail. The organic electroluminescence luminescent device of this invention has 1 or two or more organic EL devices which were formed via direct or a foundation layer on one side of a light transmission nature board and the light transmission nature board concerned, as mentioned above.

[0011]It is preferred to use here what consists of an electrical-insulation-properties substance

which the main surfaces present plate-like [parallel] mutually substantially, and gives high permeability (in general not less than 80%) to luminescence (EL light) from a luminous layer (organic luminescent material) as the above-mentioned light transmission nature board. [as an example of the quality of the material of such a light transmission nature board] Clear glass, such as alkali glass and non-alkali gas, Transparent resin, such as polyethylene terephthalate, polycarbonate, polyether sulphone, a polyether ether ketone, polyvinyl fluoride, poly acrylate, polypropylene, polyethylene, amorphous polyolefin, and fluororesin, Transparent Ceramics Sub-Division, such as translucent alumina, $BaTiO_3$, and zirconia, or quartz is mentioned.

[0012]In the organic electroluminescence luminescent device of this invention, since the lens for condensing may be formed into the light transmission nature board so that it may mention later, as the light transmission nature board concerned, planar microlens the product made of resin or glass can also be used. making the refractive index of the request part of a transparent resin board or a clear glass board here higher than the surrounding refractive index with "planar microlens" by methods, such as the diffusion polymerizing method (in the case of a transparent resin board), and an ionic exchange diffusion method (in the case of a clear glass board), -- or, The plane micro lens (planoconvex lens) of ****** is formed in the aforementioned substrate by forming a hemispherical crevice in the request part of substrates, such as a clear glass board, and making the light transmission nature material which has a refractive index which is different from the aforementioned substrate in this crevice deposit with a plasma CVD method etc. It is located in the surface of the substrate which the plane part of each plane micro lens (planoconvex lens) used as a material of the planar microlens concerned in this planar microlens.

[0013]Layer composition of an organic EL device formed in one side of a light transmission nature board mentioned above will not be limited especially if the light transmission nature board side can be made into an optical extraction side. Similarly, material of each layer which constitutes an organic EL device is not limited, either, especially if only an organic EL device which makes the light transmission nature board side an optical extraction side is obtained. And the number of the organic EL devices concerned is selectable suitably according to a use etc. of an organic electroluminescence luminescent device made into the purpose.

[0014][the light transmission nature board side] [as an example of layer composition of an organic EL device made into an optical extraction side] A being [the order of lamination from the light transmission nature board side / following the (1) - (4)] thing is mentioned, a transparent electrode (lower electrode) is used as an anode also in an organic EL device of which layer composition of following the (1) - (4), and an opposite electrode is used as the negative pole.

[0015](1) A transparent electrode (lower electrode) / luminous layer / opposite electrode (2) transparent electrode (lower electrode) / hole injection layer / luminous layer / opposite

electrode (3) transparent electrode (lower electrode) / luminous layer / electronic injection layer / opposite electrode (4) transparent electrode (lower electrode) / hole injection layer / luminous layer / electronic injection layer / opposite electrode [0016]An organic EL device may be directly formed on one side of a light transmission nature board mentioned above, and may be formed via a foundation layer. As for a field in which the organic EL device concerned is formed, since in any case it will become easy to produce luminosity nonuniformity for an element and the luminescence stability of an element will fall easily if thickness of a luminous layer of an organic EL device is changed locally, it is preferred that it is a flat field substantially. By forming an organic EL device on a flat field substantially, it becomes easy to make uniform substantially thickness of a luminous layer of the organic EL device concerned, and it becomes easy to obtain an organic EL device with high luminescence stability as the result that there is little luminosity nonuniformity. "A substantially flat field" as used in the field of this invention means a field whose root mean square value of surface coarseness is 50 nm or less in general.

[0017]It is useful as a way stage for acquiring "a substantially flat field" to provide the above-mentioned foundation layer. Since it is preferred to carry out distance of the lower electrode (transparent electrode) and the lens for condensing which constitute the organic EL device within the limits of specification in the organic electroluminescence luminescent device of this invention so that it may mention later, it is preferred also as a way stage for adjusting the aforementioned distance to provide the above-mentioned foundation layer.

[0018]When providing the above-mentioned foundation layer in one side of a light transmission nature board, as the material, clear glass, transparent resin, transparent Ceramics Sub-Division, etc. can be used. A foundation layer can be provided by making the plate-like member for foundation layers produced, for example as a separate member adhere on a light transmission nature board using transparent adhesives etc. The layer of predetermined film thickness is formed on a light transmission nature board by the film production method of the request according to the material of the foundation layer, for example, a vacuum evaporation method, the sputtering method, the ion plating method, the CVD method, the sol-gel method, the applying method, etc., Also by grinding the surface if needed, a foundation layer can be provided on a light transmission nature board.

[0019]In the organic electroluminescence luminescent device of this invention which has a foundation layer provided the light transmission nature board and organic EL device which were explained above, and if needed, 1 or two or more lenses for condensing are provided between the lower electrode which constitutes the organic EL device, and the outer surface of a light transmission nature board. In a light transmission nature board when it is what has the foundation layer which the organic electroluminescence luminescent device made into the purpose mentioned above, specifically, 1 or two or more lenses for condensing are formed into

the foundation layer concerned or the light transmission nature board.
[0020]Since EL light emitted from an organic EL device is condensed and the above-mentioned lens for condensing is used, So that the direction of the refractive index (absolute index of refraction) of the material of a light transmission nature board may become smaller than the refractive index (absolute index of refraction) of lens material, in forming the lens concerned into a light transmission nature board, Each material is chosen so that the direction of the refractive index (absolute index of refraction) of foundation layer material may become smaller than the refractive index (absolute index of refraction) of lens material, in forming the lens concerned into a foundation layer on the other hand.
[0021]As for the refractive index, although it may be combined and it may be a lens, if only the lens for condensing is a convergent lens, and it may be a single lens, it is preferred to use single lenses, such as a planoconvex lens and both convex lenses, and it is preferred that it is 1.6-1.9 in general. Although the lens for condensing may be a single focal lens, since the organic EL device as a pixel is not a source of a point source and it has a limited size, it is an object side (the organic EL device side is meant.) like the planoconvex lens of a refractive-index distribution pattern. It is below the same. Especially the thing for which what has two or more focuses on an optic axis is used is preferred.
[0022]Since more EL lights can be obtained, [a light more nearly parallel to the optic axis of the lens for condensing than the case where the lens of a single focus is used if the lens which has two or more above-mentioned focuses is used as a lens for condensing] When raising optical extraction efficiency, it is, in [obtaining an organic electroluminescence luminescent device with high luminosity when it sees from the front], and is advantageous.
[0023]In using a planoconvex lens as a lens for condensing, When it forms the planoconvex lens concerned into a light transmission nature board or a foundation layer as the plane part of this planoconvex lens is located in the organic EL device side, and it uses both convex lenses, As one convex of both this convex lens is located in the organic EL device side, it forms the planoconvex lens concerned into a light transmission nature board or a foundation layer.
[0024]When forming the lens for condensing into a light transmission nature board, the lens concerned may be changed into the state where it was completely laid underground into the light transmission nature board, and the part may change it into the state where it is ****(ing) to the inner side surface (near surface in which an organic EL device is formed) or the outer surface of a light transmission nature board. on the other hand, in forming the lens for condensing into a foundation layer, it does not project from the upper surface (near field in which an organic EL device is formed) of a foundation layer -- it makes and forms.
[0025]When forming the lens for condensing into a light transmission nature board, as the optic axis becomes parallel substantially with **** of the outer surface of a light transmission nature board, also in any in the case of forming into a foundation layer, it provides the lens for

condensing. When providing two or more lenses, it is preferred to provide in it, as it is located in one plane with the center of each lens substantially parallel to the outer surface of a light transmission nature board.

[0026]Although the size of the lens for condensing used with the organic electroluminescence luminescent device of this invention and its number are suitably chosen according to the use etc. of the organic electroluminescence luminescent device made into the purpose, no matter it may use it for what use, as an organic EL device and the lens for condensing correspond, they form them on [1 to 1] plane view.

[0027][as used in the field of this invention, / here / "on / 1 to 1 / plane view, as an organic EL device and a lens for condensing correspond, they are provided"] It means that an organic EL device and a lens for condensing are provided as the following (a) and (b) are filled, when plane view of a lens for condensing and the organic EL device is carried out from a direction parallel to an optic axis of a lens for condensing.

(a) One organic EL device overlaps only with one lens for condensing, and an optic axis of a lens for condensing and its center on plane view of an organic EL device correspond substantially.

(b) A size of an organic EL device is below a size which is inscribed [below size circumscribed to a lens for condensing which has overlapped with the organic EL device concerned] in still more preferably below as for a size which overlaps mutually preferably.

[0028]Although it becomes possible to raise a rate of EL light changed into parallel light by lens for condensing by making an organic EL device and a lens for condensing correspond on [1 to 1] plane view, and providing them as mentioned above, If the distance d of the undersurface (field by the side of a light transmission nature board) of a lower electrode and a lens for condensing which constitute an organic EL device is too far, a rate of EL light changed into parallel light by the lens concerned will fall. Although based also on size relation between a size (size on plane view of a luminous layer) on plane view of an organic EL device, and a size on plane view of a lens for condensing, The aforementioned distance d has a preferred thing of the focal length f by the side of an object of a lens for condensing considered in general less than as twice, and is especially preferred. [of a thing of the aforementioned focal length f considered in general as 0.8 to 1.2 times] The aforementioned "distance d" as used in the field of this invention means distance to the undersurface (field by the side of a light transmission nature board) of a lower electrode which constitutes an organic EL device from a center of a lens for condensing.

[0029]The outline of an example of an organic electroluminescence luminescent device which provided two or more lenses for condensing into the light transmission nature board is shown in drawing 2. As for the organic electroluminescence luminescent device 20 shown in drawing 2, the plane part is the inner side surface (near field in which an organic EL device is formed.)

of the light transmission nature board 21 about the planoconvex lens (plane micro lens) 22 of plurality [side / of the light transmission nature board 21 / one side]. It is below the same. It is made to adjoin mutually and provides so that it may become, and the foundation layer 23 is formed on it, and two or more organic EL devices 24 are formed on this foundation layer 23. Each organic EL device 24 has the lower electrode (transparent electrode) 24a, the luminous layer 24b, and the opposite electrode 24c sequentially from the foundation layer 23 side, and each organic EL device 24 corresponds on [1 to 1] one the planoconvex lens (plane micro lens) 22 and plane view, respectively. This organic electroluminescence luminescent device 20 can be used as for example, a display panel or a light source.

[0030]The outline of an example of an organic electroluminescence luminescent device which provided two or more lenses for condensing into the light transmission nature board and the foundation layer, respectively is shown in drawing 3. The organic electroluminescence luminescent device 30 shown in drawing 3 opens and provides a predetermined interval in the one side side of the light transmission nature board 31, as the plane part is located in two or more planoconvex lenses (plane micro lens) 32 on the same plane as the inner side surface of the light transmission nature board 21, The foundation layer 34 in which two or more planoconvex lenses 33 are moreover formed at the predetermined intervals is formed, and two or more organic EL devices 35 are formed on this foundation layer 34. The planoconvex lens 33 in the foundation layer 34 is formed as the plane part is located on the same plane as the undersurface (field by the side of the light transmission nature board 31) of the foundation layer 34, and each planoconvex lens 33 forms both one convex lens in collaboration with either of the planoconvex lenses 32 in the light transmission nature board 31. Have each organic EL device 35 sequentially from the foundation layer 34 side, and the lower electrode (transparent electrode) 35a, the luminous layer 35b, and the opposite electrode 35c, [each organic EL device 35] It corresponds on [1 to 1] one both convex lenses (what consists of the planoconvex micro lens 32 and the planoconvex lens 33) and plane view, respectively. This organic electroluminescence luminescent device 30 can be used as for example, a display panel.

[0031]And the outline of an example of an organic electroluminescence luminescent device which provided two or more lenses for condensing into the foundation layer is shown in drawing 4. The organic electroluminescence luminescent device 40 shown in drawing 4 forms the foundation layer 43 by which two or more planoconvex lenses 42 adjoin mutually, and are formed on one side of the light transmission nature board 41, and forms two or more organic EL devices 44 on this foundation layer 43. The planoconvex lens 42 in the foundation layer 43 is formed so that the plane part may serve as the upper surface (field by the side of the organic EL device 44) of the foundation layer 43. Each organic EL device 44 has the lower electrode (transparent electrode) 44a, the luminous layer 44b, and the opposite electrode 44c

sequentially from the foundation layer 43 side, and each organic EL device 44 corresponds on [1 to 1] one the planoconvex lens 42 and plane view, respectively. This organic electroluminescence luminescent device 40 can be used as for example, a display panel.

[0032]In forming the foundation layer 43 in which the planoconvex lens 42 as shown in drawing 4 is formed on the light transmission nature board 41, the following technique other than sticking planar microlens on a light transmission nature board is applicable, for example. First, a transparent resin layer is formed on the substrate of the request of those other than what is used as the above-mentioned light transmission nature board 41, and this transparent resin layer is patterned in the shape of a dot with the photolithographic method etc. Subsequently, this substrate is heated and melting of the above-mentioned transparent resin layer patterned in the shape of a dot is carried out. Since each dot which consists of transparent resin layers becomes hemispherical with surface tension at this time, the lens for condensing is obtained by making it solidify, while it has been hemispherical. Next, after forming a photo-setting resin layer or a thermosetting resin layer as said lens for condensing is covered, and arranging a desired light transmission nature board on the layer, an aforementioned photo-setting resin layer or thermosetting resin layer is stiffened. A photo-setting resin layer or a thermosetting resin layer after making it harden turns into a "foundation layer" as used in the field of this invention. Then, the foundation layer 43 in which the planoconvex lens 42 is formed can be formed on the light transmission nature board 41 by exfoliating the substrate used in order to form the lens for condensing.

[0033]Although the organic electroluminescence luminescent device of this invention should just have a foundation layer provided a light transmission nature board, organic electroluminescence and a lens for condensing which were explained above, and if needed, [the luminescent device] A color conversion film or a color filter (a micro color filter is included), a sealed part for organic EL devices, etc. may be provided in addition to such members forming.

[0034]The above-mentioned color conversion film distributes a fluorescent molecule in a transparent resin layer, and it is used in order to change into a desired color EL light emitted from an organic EL device. The color conversion film concerned can be provided in a request part between a lower electrode (transparent electrode) and a lens for condensing which constitute an organic EL device. When an organic electroluminescence luminescent device has a foundation layer, it is also possible to use the foundation layer concerned as a color conversion film.

[0035]In an organic electroluminescence luminescent device of this invention explained above, A lens for condensing is provided between a lower electrode which constitutes an organic EL device, and an outer surface of a light transmission nature board in which the organic EL device concerned is formed, Since this lens for condensing and organic EL device correspond

on [1 to 1] plane view, it is changed into a light parallel to an optic axis of a lens for condensing, and a rate of EL light to emit (changed into a light parallel to **** in the surface outside a light transmission nature board) can be easily made high.

[0036]For this reason, in the organic electroluminescence luminescent device of this invention, it is possible to make small easily the grade of diffusion of EL light in an optical extraction side (outer surface of a light transmission nature board), and luminosity when it sees from the extraction efficiency and the front of light can be easily raised as that result. Distortion of a picture is able to obtain a small thing for the organic electroluminescence luminescent device of this invention to a display panel and ** case. The organic electroluminescence luminescent device of this invention which has the above-mentioned characteristic is preferred as a field light source or a display panel.

[0037]

[Working example]Hereafter, the embodiment of this invention is described.

[as production **** of an embodiment 1(1) organic-electroluminescence luminescent device, and a light transmission nature board] The plane micro lens (planoconvex lens) whose lens diameter is 100 micrometers prepared the planar microlens (made by Nippon Sheet Glass Co., Ltd.) currently formed in 100x200 100-micrometer pitches into the glass substrate by the ionic exchange method. The focal length f of each plane micro lens currently formed in this planar microlens is 220 micrometers, and the plane micro lens concerned is used as a lens for condensing. Thin board glass with a thickness of 200 micrometers which ground the surface and set the root mean square value of the surface coarseness to 20 nm as a plate shaped member for foundation layers was prepared. And in the above-mentioned monotonous macro lens, the plane part of the plane micro lens (planoconvex lens) stuck the above-mentioned thin board glass with transparent adhesives on the field of the side which has become a part of surface of the planar microlens concerned. At this time, the sum of the film thickness of a transparent-adhesives layer and the thickness of thin board glass was 220 micrometers.

[0038]Then, the organic EL device was formed in the following ways on the above-mentioned thin board glass. First, the In-Zn-O system amorphous oxide film of 200 nm of film thickness was produced on the above-mentioned thin board glass by the DC magnetron sputtering method. At this time, the sintered compact (atomic ratio In/(In+Zn) =0.67 of In) which consists of In_2O_3 and ZnO is used as a sputtering target, introducing the mixed gas ($Ar:O_2$=1000:2.8 (volume ratio)) of argon gas and oxygen gas to a vacuum chamber, so that the internal pressure power inside a vacuum chamber may serve as $3x10^{-1}$Pa -- a sputtering output -- 20W -- substrate temperature was set as room temperature and sputtering was performed.

[0039]Next, the above-mentioned In-Zn-O system amorphous oxide film was patterned with the photolithographic method, and the lower electrode (transparent electrode) which presents band-like [70 micrometers-wide] was formed a total of 100 and in the shape of a stripe in a

100micro pitch.

[0040]After cleaning ultrasonically by immersing the light transmission nature board (planar microlens) which even the above-mentioned lower electrode formed into isopropyl alcohol, using ultraviolet exposure machine UV-300 by a SAMUKO international company, ultraviolet rays and ozone were used together and it washed for 30 minutes.

[0041]The light transmission nature board (planar microlens in which even the lower electrode is formed) after washing is attached to the substrate holder of a commercial vacuum evaporation system, [by producing the opposite electrode (negative pole) of the 1st hole injection layer of 25 nm of film thickness, the 2nd hole injection layer of 40 nm of film thickness, the luminous layer of 60 nm of film thickness, and 200 nm of film thickness one by one on the field in which the above-mentioned lower electrode is formed in the light transmission nature board concerned] The organic EL device of the appointed number was formed on the aforementioned thin board glass (foundation layer).

[0042]At this time, as a material of the 1st hole injection layer, the phthalocyanine like Cu **. (it is hereafter written as "CuPc".) -- as the material of the 2nd hole injection layer -- An N and N'-screw (3-methylphenyl) - N. [N'- diphenyl (1 and 1'-biphenyl)-4, 4'-Gia Min] (it is hereafter written as "TPD".) -- as a material of a luminous layer. [8-KINORINORU aluminium complex] (it is hereafter written as "Alq".) -- in producing which layer, using an aluminum-Li alloy (Li content; 2 weight %) as a material of an opposite electrode, internal pressure power inside a vacuum chamber was set to $5x10^{-4}$Pa.

[0043]So that film production of an opposite electrode may be performed using a predetermined mask and an opposite electrode and the lower electrode mentioned above may intersect perpendicularly on plane view, And as each intersection on the plane view of an opposite electrode and a lower electrode was circumscribed to one which is provided into the light transmission nature board (planar microlens) of plane micro lenses on plane view, it formed a total of 200 and a 70-micrometer-wide opposite electrode in a 100-micrometer pitch.

[0044]Opposite electrodes are beforehand separated from a thin board glass surface with an insulator rib set up at the predetermined intervals having covered on a lower electrode.
It has come to be able to perform negative pole separation processing.
This insulator rib is formed as **** in advance of film production of the 1st hole injection layer etching, after producing an insulator film (photolithographic method).

[0045]When even an organic EL device formed as mentioned above, an organic electroluminescence luminescent device made into the purpose was obtained. An outline of this organic electroluminescence luminescent device is shown in drawing 1. As shown in drawing 1, [the above-mentioned organic electroluminescence luminescent device 10] The foundation layer 3 which consists of thin board glass is formed on a field of a side in which the plane micro lens (a planoconvex lens; lens for condensing) 2 is formed in the light transmission

nature board 1 which consists of planar microlenses, The 100x200 organic EL devices 4 whose sizes on plane view are 70x70 micrometers are formed on this foundation layer 3. On [1 to 1] plane view, as the plane micro lens 2 and the organic EL device 4 which are the lenses for condensing correspond, they are formed. That is, when the plane of the plane micro lens 2 concerned and the organic EL device 4 is carried out from a direction parallel to an optic axis of the plane micro lens 2, as the organic EL device 4 whose size on plane view is 70x70 micrometers is substantially inscribed in the plane micro lens 2 which is 100 micrometers in diameter, it is formed.

[0046]The lower electrode (transparent electrode) 4a in which each organic EL device 4 consists of an In-Zn-O system amorphous oxide film, The hole injection layer 4b of two-layer structure (the 1st hole injection layer that consists of a CuPc film, and the 2nd hole injection layer that consists of a TPD film) formed on this lower electrode 4a, It consists of the luminous layer 4c which consists of an Alq film formed on this hole injection layer 4b, and the opposite electrode 4d which consists of an aluminum-Li alloy film formed on this luminous layer 4c. And opposite electrode 4d is separated from the foundation layer 3 surface with the insulator rib 5 which chipped on the lower electrode 4a and was set up.

[0047]In the organic electroluminescence luminescent device 10 which has the above-mentioned structure, [thickness of the foundation layer 3] [adhere / this foundation layer 3 / at 200 micrometers / by a transparent adhesive line (not shown) which is 20 micrometers in thickness / on the light transmission nature board 1] The distance d of the lower electrode 4a and the plane micro lens 2 which constitute the organic EL device 4 is the same 220 micrometers as the focal length f of the plane micro lens 2. Since each organic EL device 4 can be used as a pixel, this organic electroluminescence luminescent device 10 can be used as a display panel. At this time, each organic EL device 4 emits light green.

[0048](2) An organic electroluminescence luminescent device produced by the display-properties test above (1) was connected to a predetermined drive circuit, and a simple matrix drive was performed on condition of the duty ratio 1/100 and the drive voltage 10V. When all the organic EL devices were made to emit light and luminosity at this time was measured from the front of an organic electroluminescence luminescent device, the result 210cd/m^2 was obtained. When this organic electroluminescence luminescent device performed a character representation, distortion was not substantially observed in a displayed character.

[0049]It is made to be the same as that of Embodiment 1 (1) except not having provided a lens for condensing (plane micro lens) between a lower electrode which constitutes an organic EL device, and an outer surface (a field in which an organic EL device is formed is a field by the side of opposite) of the aforementioned glass substrate, using a glass substrate as a comparative example 1 light-transmission nature board, An organic electroluminescence luminescent device was produced. When luminosity when it saw from the front on Embodiment

1 (2) and the conditions about this organic electroluminescence luminescent device was measured, it was 100cd/m^2.

[0050]About each organic electroluminescence luminescent device produced by an organic electroluminescence luminescent device and the comparative example 1 which were produced in measurement embodiment 1 of angular distribution of radiant intensity (1), angular distribution of radiant intensity at a time of making a 1-pixel organic EL device emit light was measured, and integration by a solid angle was performed. As a result, it became clear that a luminescence output from a unit pixel (organic EL device) of an organic electroluminescence luminescent device produced in Embodiment 1 (1) was 2.1 times the luminescence output from a unit pixel (organic EL device) of an organic electroluminescence wave quantity device produced by the comparative example 1. This shows that it is higher than optical extraction efficiency of an organic electroluminescence luminescent device which a direction of optical extraction efficiency of an organic electroluminescence luminescent device produced in Embodiment 1 (1) produced by the comparative example 1.

[0051]a size on plane view of embodiment 2 organic EL device being 50x50 micrometers, and, An organic electroluminescence luminescent device which has 100x200 organic EL devices was produced like Embodiment 1 except having made into 1.2 times of the focal length f of the plane micro lens concerned distance d of a lower electrode and a plane micro lens which constitute an organic EL device. A place which did a display-properties examination on Embodiment 1 (2) and the conditions about this organic electroluminescence luminescent device, Luminosity at a time of making all the organic EL devices emit light (luminosity measured from the front of an organic electroluminescence luminescent device) was 250cd/m^2, and when a character representation was performed, distortion of a character was not accepted.

[0052]

[Effect of the Invention]As explained above, according to this invention, it becomes possible to provide easily an organic electroluminescence luminescent device with both high luminosity when it sees from the extraction efficiency and the front of light.

[Brief Description of the Drawings]

[Drawing 1]It is a fragmentary sectional view showing the outline of the organic electroluminescence luminescent device produced in Embodiment 1.

[Drawing 2]It is an outline sectional view for explaining the allocation position of the lens for condensing and an example of allocation specification which are 1 members forming of the organic electroluminescence luminescent device of this invention.

[Drawing 3]It is an outline sectional view for explaining the allocation position of the lens for condensing which is 1 members forming of the organic electroluminescence luminescent device of this invention, and other examples of allocation specification.
[Drawing 4]It is an outline sectional view for explaining the allocation position of the lens for condensing which is 1 members forming of the organic electroluminescence luminescent device of this invention, and other examples of allocation specification.
[Explanations of letters or numerals]
10, 20, 30, 40 -- An organic electroluminescence luminescent device, and 1, 21, 31, 41 -- Light transmission nature board, 2, 22, 32, 33, 42 [-- Lower electrode which constitutes the organic EL device (transparent electrode).] -- The lens for condensing (plane micro lens), and 3, 23, 34, 43 -- A foundation layer, and 4, 24, 35, 44 -- An organic EL device, 4a, 24a, 35a, 44a

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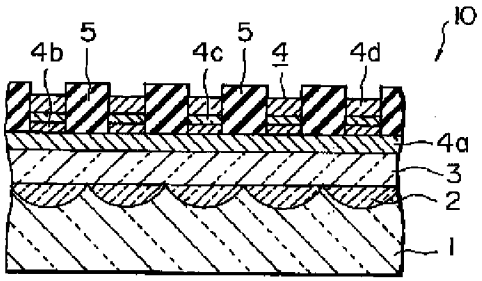
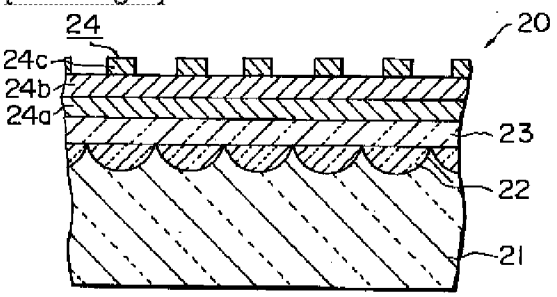
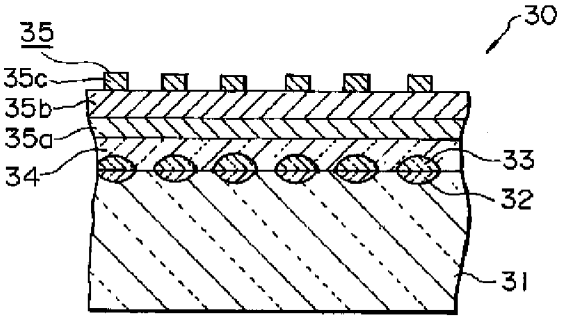
[Drawing 1]



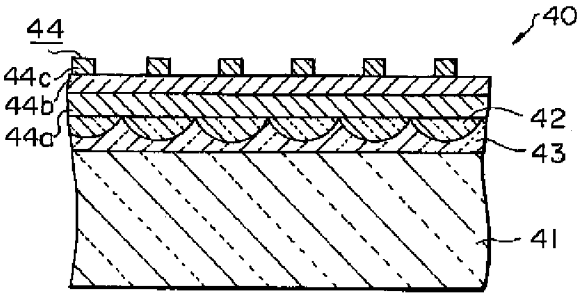
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]